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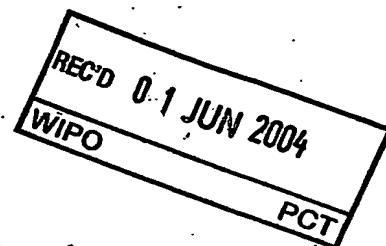
PCT/IB 04 / 01717  
(01.06.04)

*Certificate*

PATENT KANTOOR  
DEPARTEMENT VAN HANDEL  
EN NYWERHEID

PATENT OFFICE  
DEPARTMENT OF TRADE AND  
INDUSTRY

Hiermee word gesertifiseer dat  
This is to certify that



the documents annexed hereto are true copies of:

Application forms P.1 and P.3, provisional specification and drawings of South African Patent Application No. 2003/4107 as originally filed in the Republic of South Africa on 27 May 2003 in the name of CSIR for an invention entitled:  
"A METHOD OF PROTECTING A TRACK VEHICLE "

**PRIORITY  
DOCUMENT**

SUBMITTED OR TRANSMITTED IN  
COMPLIANCE WITH RULE 17.1(a) OR (b).

Geteken te

**PRETORIA**

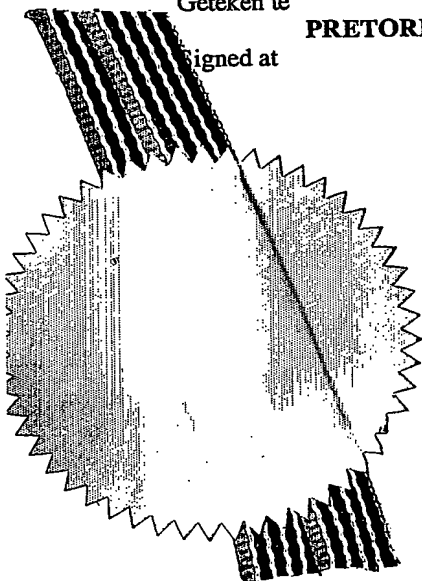
Signed at

in die Republiek van Suid-Afrika, hierdie

in the Republic of South Africa, this

10<sup>th</sup> dag van May 2004  
day of

.....  
Registrar of Patents



REPUBLIC OF SOUTH AFRICA  
PATENTS ACT, 1978  
APPLICATION FOR A PATENT AND  
ACKNOWLEDGEMENT OF RECEIPT  
(Section 30(1) Regulation 22)

FORM P.1 REVENUE  
(to be lodged in duplicate)

THE GRANT OF A PATENT IS HEREBY REQUESTED BY THE UNDERMENTIONED APPLICANT  
ON THE BASIS OF THE PRESENT APPLICATION FILED IN DUPLICATE

21 01 PATENT APPLICATION NO 2003/4107 A&A REF V15759 SCF/cve

71 FULL NAME(S) OF APPLICANT(S)

CSIR

ADDRESS(ES) OF APPLICANT(S)

SCIENTIA, PRETORIA, GAUTENG, REPUBLIC OF SOUTH AFRICA

54 TITLE OF INVENTION

A METHOD OF PROTECTING A TRACK VEHICLE

Only the items marked with an "X" in the blocks below are applicable.

☐ THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANYING FORM P.2. The earliest priority claimed is

Country:

No:

Date:

☐ THE APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION NO 21 01

☐ THIS APPLICATION IS A FRESH APPLICATION IN TERMS OF SECTION 37 AND BASED ON  
APPLICATION NO 21 01

THIS APPLICATION IS ACCOMPANIED BY:

- ☒ A single copy of a provisional specification of 6 pages  
☒ Drawings of 2 sheets  
☐ Publication particulars and abstract (Form P.8 in duplicate) (for complete only)  
☐ A copy of Figure of the drawings (if any) for the abstract (for complete only)  
☐ An assignment of invention  
☐ Certified priority document(s). (State quantity)  
☐ Translation of the priority document(s)  
☐ An assignment of priority rights  
☐ A copy of Form P.2 and the specification of RSA Patent Application No 21 01  
☒ Form P.2 in duplicate  
☐ A declaration and power of attorney on Form P.3  
☐ Request for ante-dating on Form P.4  
☐ Request for classification on Form P.9  
☐ Request for delay of acceptance on Form P.4  
☐ Extra copy of informal drawings (for complete only)

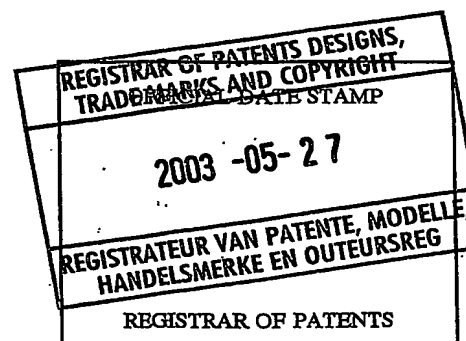
74 ADDRESS FOR SERVICE: Adams & Adams, Pretoria

Dated this 27th day of May 2003

ADAMS & ADAMS  
APPLICANTS PATENT ATTORNEYS

The duplicate will be returned to the applicant's address for service as  
proof of lodging but is not valid unless endorsed with official stamp

A&A P201



(Section 30 - Regulation 8, 22(i)(c) and 33)

A&A Ref: V15759 SCF/cve

PATENT APPLICATION NO		
21	01	2003/4107

LODGING DATE	
22	27 May 2003

FULL NAME(S) OF APPLICANT(S)	
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71	CSIR
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FULL NAME(S) OF INVENTOR(S)	
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72	JOYNT, Vernon Peregrin
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EARLIEST PRIORITY CLAIMED	COUNTRY	NUMBER	DATE
33	-	31	-

NOTE: The country must be indicated by its International Abbreviation - see schedule 4 of the Regulations

TITLE OF INVENTION	
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54	A METHOD OF PROTECTING A TRACK VEHICLE
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\* I/We

STRYDOM, Johan  
hereby declare that :-

1. ~~I/we am/are the applicant(s) mentioned above;~~

\*\* 2. I/we have been authorized by the applicant(s) to make this declaration and have knowledge of the facts herein stated in the capacity of Technology Manager of the applicant(s);

\*\*\* 3. the inventor(s) of the abovementioned invention is/are the person(s) named above and the applicant(s) has/have acquired the right to apply by virtue of an assignment from inventor (s).

4. to the best of my/our knowledge and belief, if a patent is granted on the application, there will be no lawful ground for the revocation of the patent;

\*\*\*\* 5. ~~this is a convention application and the earliest application from which priority is claimed as set out above is the first application in a convention country in respect of the invention claimed in any of the claims; and~~

6. the partners and qualified staff of the firm of ADAMS & ADAMS, patent attorneys, are authorised, jointly and severally, with powers of substitution and revocation, to represent the applicant(s) in this application and to be the address for service of the applicant(s) while the application is pending and after a patent has been granted on the application.

SIGNED THIS 20th DAY OF June

2003

Company Name: CSIR

Full Names: Johan Strydom

Capacity: Technology Manager

(no legalization necessary)

\* In the case of application in the name of a company, partnership or firm, give full names of signatory/signatories, delete paragraph 1, and enter capacity of each signatory in paragraph 2.

\*\* If the applicant is a natural person, delete paragraph 2.

\*\*\* If the right to apply is not by virtue of an assignment from the inventor(s), delete "an assignment from the inventor(s)" and give details of acquisition of right.

\*\*\*\* For non-convention applications, delete paragraph 5.

ADAMS & ADAMS  
PATENT ATTORNEYS  
PRETORIA

FORM P6

REPUBLIC OF SOUTH AFRICA  
Patents Act, 1978

**PROVISIONAL SPECIFICATION**  
(Section 30 (1) - Regulation 27)

21	01	OFFICIAL APPLICATION NO
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**2003/4107**

22	LODGING DATE
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**27 May 2003**

71	FULL NAME(S) OF APPLICANT(S)
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**CSIR**

72	FULL NAME(S) OF INVENTOR(S)
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**JOYNT, Vernon Peregrin**

54	TITLE OF INVENTION
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**A METHOD OF PROTECTING A TRACK VEHICLE**

This invention relates to a method of protecting a track vehicle, such as an armored vehicle, e.g. an armored tank, against the effects of a landmine explosion, e.g. an anti-tank landmine explosion. It relates also to a converted track vehicle, and to a conversion kit for a track vehicle.

5 In accordance with a first aspect of this invention, there is provided a method of protecting a track vehicle against the effects of a landmine explosion, including conducting shock waves generated by the landmine explosion laterally outwardly by means of a shock wave guide member having a  
10 relatively high acoustic speed and located proximate a track of the track vehicle.

For purposes of this specification, terms denoting direction, such as fore, rear, lateral, and the like should be interpreted with reference to a normal direction of forward travel of a track vehicle. The term "laterally outward" means  
15 "sideways away from (the track vehicle)".

By "relatively high" acoustic speed is meant an acoustic speed higher than the acoustic speed of the metal used in components of the track vehicle. Such metal, e.g. steel, aluminum, and alloys thereof, generally have an  
20 acoustic speed of about 5000 m/sec. In accordance with the invention, the material of each shock wave guide member may be of glass, a suitable ceramic such as an alumina, or the like. The acoustic speed of glass is about 6000 m/sec, and that of ceramic is above 6000 m/sec., up to about 8000 m/sec.

The invention extends further to a track vehicle having tracks guided on bogey wheels, which track vehicle is converted to protect it against the effects of a landmine explosion, the track vehicle comprising a plurality of shock wave guide members proximate tracks and bogey wheels thereof.

Typically, guide members may be provided in wells of bogey wheels, i.e. annular cavities surrounding the hubs and radially inward of rims of the bogey wheels; as well as immediately above a bottom run of each track intermediate bogey wheels.

Each guide member may be of composite construction, comprising a plurality of directed laminates of the high acoustic speed material. The laminates may be sandwiched in-between layers of material having low acoustic speed, e.g. polyurethane, rubber, and like. The laminates may be oriented to extend obliquely laterally outwardly in use.

Guide members proximate tracks intermediate bogey wheels may have layers of low friction material such as Teflon on their surfaces interfacing with the tracks. Those surfaces may be profiled snugly to be received with little clearance, or even slight rubbing, on inner surfaces of the tracks.

In accordance with a further aspect, the invention extends yet further to shock wave guide members as herein described shaped to be located proximate tracks and proximate bogey wheels of a track vehicle.

The invention is now described by way of example with reference to the accompanying diagrammatic drawings. In the drawings

Figure 1 shows, in fragmentary side view, a track vehicle converted in accordance with the invention;

Figure 2 shows, to a larger scale, fragmentarily, a bogey wheel of the track vehicle of Figure 1, converted in accordance with the invention;

Figure 3 shows, in diametrical section, the bogey wheel of Figure 2; and

Figure 4 shows, in cross section, to a larger scale, a guide member proximate a track of the track vehicle of Figure 1.

5 With reference to the drawings, a track vehicle in the form of an armored tank is generally indicated by reference numeral 10. The track vehicle 10 has a pair of tracks 12 guided along a lower run of each track on bogey wheels 14. The track is shown fragmentarily only, and only one track 12 is shown, also fragmentarily.

10 In accordance with the invention, a ~~first kind~~ of guide member, generally indicated by reference numeral 16, is located within wells of the bogey wheels 14, i.e. annularly intermediate hubs 14.1 and rims 14.2 of the respective bogey wheels 14.

15 In the event that the bogey wheel 14 has webs 14.3 at circumferentially spaced positions within said wells, the guide member 16 is in the form of a composite guide member comprising a plurality of segments 16.1 shown in Figure 2.

20 As can best be seen in Figure 3, each segment has a plurality of laminates 16.2 sandwiched in-between dividing layers 16.3 which may be of a yielding, even resilient, low acoustic speed material such as polyurethane, rubber or the like. The laminates 16.2 are oriented laterally outwardly.

25 In the event of a landmine explosion underneath the bogey wheel 14, shock waves generated by the landmine explosion will propagate through the track 12, through the rim 14.2 of the bogey wheel 14 immediately above the track 12 and will be "loaded into" the respective segment or segments 16.1. The  
30 Applicant has realized that shock waves encounter resistance to propagation inversely proportional to the acoustic speed of a material. Thus, in a material

having a high acoustic speed like glass, especially ceramics, such as that of the guide member 16, the shock waves are guided effectively laterally outwardly in accordance with the orientation of the laminates. It is further to be appreciated that, should a component of the shock waves be conducted obliquely along such a laminate, when it reaches a dividing layer 16.3 having a low acoustic speed and thus offering high resistance to propagation of shock waves, the shock waves are deflected back into the high acoustic speed material which assists in guiding the shock waves laterally outwardly.

When the shock waves reach the surface of the guide member, and preferably it should do so at approximately right angles, the shock waves, when they encounter the neighboring air, which has a low acoustic speed, cause spalling of the material which results in a fragment or fragments of material to be liberated and to be projected generally in the direction of spalling i.e. laterally outwardly.

In this regard, the Applicant has realized that a blast effect generated by the landmine explosion and following the shock waves in time, generally follows the path or route of least resistance. In this regard, the Applicant has further appreciated that the shock waves crack and pulverize the material of the guide member, but at a propagation speed substantially lower than the acoustic speed. Thus, the guide member remains intact fully to propagate the shock waves, but immediately behind the shock waves, cracks and pulverizes to facilitate being displaced or blown away by the blast effect. Thus, a route of lesser resistance is created in the direction in which the shock waves were guided. Furthermore, the effect of spalling and of a fragment being projected from the outer surface creates a region of low pressure which is followed by the blast effect.

Thus, the Applicant has realized that managing or guiding of the shock waves in a predetermined direction away from a body of the track vehicle



not only protects the body against the effect of the shock waves, but also that the blast effect tends to follow the leader shock waves and that the body of the track vehicle is thus also protected against the effects of the blast.

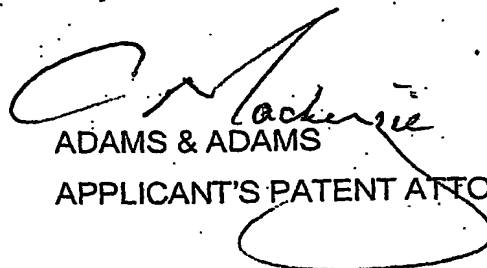
5 Similarly, with reference to Figure 4, a guide member 18 comprises a plurality of laminates 18.2 sandwiched by dividing layers 18.3 of polyurethane, rubber, or the like. By way of development, the guide member 18 is profiled at its interface with the track 12, to fit snugly over the track 12, and even to rub against the track 12. To mitigate such rubbing, a rubbing surface 20 of a low friction  
10 material such as Teflon is provided at the interface.

The mechanism of guiding of the shock waves in the case of the guide member 18 is exactly the same as that of the guide member 16 and also the creation of a route of lesser resistance is similar.

15 The Applicant believes that the invention provides a simple, elegant and relatively inexpensive method of managing shock waves by directing or guiding the shock waves in a desired direction, and furthermore that such guiding of the shock waves creates a route of lesser resistance which is followed by the  
20 blast in preference thus also protecting vulnerable and valuable parts of the vehicle against the effect not only of the shock waves, but also of the blast.

DATED THIS 27<sup>th</sup> DAY OF MAY 2003

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